Scientist and Mathematician Extraordinaire

Isaac Newton

"Errors are not in the art but in the artificers."

—Isaac Newton
(1642–1727)

Imagine this: It's the summer of 1666, you are twenty-two years old, and you are sitting beneath a tree in your mother's orchard.

You have already been trying to understand what keeps the moon in its orbit around the earth and the planets in their courses around the sun, but after an apple falls on your head, you begin to search seriously for the answers to your questions.

Your name is Isaac Newton, and your achievements in physics and mathematics will be the basis of physics and mathematics for the next three hundred years. You are considered by many to be one of the greatest scientists of all time.

Newton was born prematurely just after midnight on

Christmas Day 1642 (the same year that Galileo died) in the manor house of Woolsthorpe in Lincolnshire, England, and was not expected to survive. His father, a fairly prosperous farmer, had died three months earlier, leaving Isaac's mother, Hannah, to raise the tiny boy on her own.

His mother remarried when he was three years old, a marriage of convenience, so that she could provide for her son. Her new husband, a wealthy clergyman, insisted that Newton remain with his maternal grandmother at Woolsthorpe Manor, so that Hannah could look after her new family.

Newton's childhood was a lonely time. He made few friends and kept to himself, often spending the day in his room making models, kites, sundials, and little mechanical devices.

Before long, he became well known in the district for his creations, and local people were amazed by his skill at constructing exact replicas of carts and wheeled machines.

When he was ten, his stepfather died and his mother returned to live at the manor with her three children from her second marriage.

Newton was considered an average student by his teachers and antisocial by his classmates. He admitted later that he ignored his studies and spent most of his time making models and carrying out his own experiments.

When provoked by a school bully much larger than himself who also happened to be first academically, Newton fought back and ended up winning the fight. After his victory, he decided that if he could beat the bully physically, maybe he was also his match academically, and he began to pay more attention to his studies. He became an intellectual leader, gaining the respect of his teachers and his classmates. Before the fight, he was near the bottom of his class. After the fight, he

worked his way up to becoming the top student at his school.[10]

In 1661, the eighteen-year old Newton was admitted to the prestigious Cambridge University. His mother refused to pay his tuition because she wanted him back home to run the family farm, so he earned his keep by cleaning the rooms of the paying students, serving meals, and doing menial jobs.

At Cambridge he read everything he could by the great mathematicians, scientists, and philosophers of the time and graduated in 1664. He remained at Cambridge after graduation to pursue graduate study.

In 1664 he began his experiments with light and discovered that when white light is shone through a prism, it splits into a rainbow which he called the spectrum, the light ranging from violet at the top to red at the bottom.

Once an experiment was devised, he repeated it many times in order to eliminate errors or any possibility of chance. He then kept impeccable records of his findings.

When The Great Plague broke out in London in 1665, Cambridge University was forced to close its doors for a year, and twenty-three-year-old Newton returned home for that year.

He later called 1666 his "Miraculous Year" because it was there in the solitude of the family's countryside manor that he began to make incredible breakthroughs in mathematics and physics including the answer to a problem that had eluded the most gifted mathematicians for years—the binomial theorem. He did his greatest thinking during those eighteen months and he worked harder than ever.

It was also in 1666 at Wolsthorpe where the famous legend of Newton and the apple was born. While he was napping under a tree, an apple fell on his head and he awoke with a jolt.

According to the legend, he wondered why the apple always fell down and concluded that the apple falling and the moon orbiting were governed by the same force: gravity—or what Newton later referred to as the law of universal gravitation.[11]

Soon after that he began to work on what was to be the greatest development in the history of mathematics—calculus.

In 1667 he was made a fellow at Trinity College and, in spite of living in the middle of a busy university, he led a solitary life. He usually ate in his own room, and when he did join the other professors in the college dining room, he was often lost in thought and sometimes forgot to eat.

Newton's ability to concentrate was extraordinary, and according to one legend, he dismounted on his way home from town one day and walked his horse by its bridle so it could rest. As always, his mind wandered. Perhaps he was thinking about the four-wheel carriage he'd just built or the system of shorthand he'd created, or maybe he was just watching the sunlight on the grass and wondering what made the grass green. Miles and hours later he arrived home not even aware that the horse had long ago slipped out of its bridle, and he had walked the whole way back, alone.[12]

Newton was also very untidy, rarely bothering to change his clothes or fasten his shoes or comb his long hair. He seldom got any exercise either because he felt any time away from his studies was time lost.

He was required to give one lecture a week, but very few people attended his lectures because few understood them. Sometimes there was no one there at all and he read to the walls.

The work Newton began during the "Miraculous Year" would be the basis of mathematics and physics for the next three hundred years.

Newton's laws of motion explain how forces act upon objects, whether moving or stationary. By applying these laws to any mechanical system, it's possible to predict the effect a force will have on an object.

He also worked out a theory of gravity to explain how the planets travel in their orbits around the sun. The same theory also explains why we remain held firmly to earth and do not all float off into space.

His book *Principia Mathematica*, which he wrote in only eighteen months, was published in 1687 and contained what became known as Newton's laws of motion. This is considered by many to be the greatest scientific work ever produced.

In 1705 he was knighted by Queen Anne for his great work in both science and public service, the first scientist ever to be honored in this way.

Sir Isaac Newton died a painful death on March 20, 1727, at age eighty-four from gout, lung inflammation, and kidney stones. He was buried among Britain's kings and queens in London's Westminster Abbey, the first scientist to be so honored.

Today, more than 350 years after his birth, scientists from around the world still use the very same principles and ideas that were first laid down by his *Principia* in 1687.

Newton created an entirely new approach to science and an original way of solving many of its most fundamental problems. He once explained that when he was faced with a problem, he kept it in his mind until he solved it. He often went without food or sleep until he was satisfied with his answer.

Today, Newton's laws of motion are used in all areas of science such as designing cars, planning the course of a spaceship, and building aircraft engines. And the calculations needed to successfully complete the 500,000-mile round-trip to the moon are based on his law of universal gravity.

Without his revolutionary method of mathematical calculation—calculus—no major scientific discovery such as Einstein's theory of relativity would have been possible.

Isaac Newton was indisputably one of the greatest scientists in history. The discoverer of the fundamental laws of physics and the inventor of calculus, his achievements marked the culmination of the movement that brought modern science into being.

He once said, "If I have seen further than most men, it is by standing on the shoulders of giants."[13] His "giants" included such great men as Copernicus, Kepler, Galileo, and Descartes.